

HISTORY OF MEDICINE

Perceptions of malaria transmission before Ross' discovery in 1897

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In early 1919, Lady (Dorothy) Stanley (fig 1), widow of the high profile African explorer Henry Morton Stanley (1841-1904), wrote to Ronald Ross (1857-1932), the man who had discovered mosquito transmission of malaria in 1897 (fig 2)¹:

"...My husband, Stanley, of course, had never [he had apparently written to Ross in 1895-6] attributed malaria to the mosquito, though malaria was his deadly enemy all through his life in Africa—and even in [his] early youth, in Arkansas U.S. ... He used to think it was "miasmatic"—and in the Great Forest, he told me, he could *smell and taste* malaria ... he thought malaria was in some cases borne by wind".

She continued:

"... he had a glass screen put up on his boat [a "little steam boat *En Avant*" which he used on the Congo]—and the fever disappeared ... We all know, now, thanks to you—the real cause of malaria ...".

In a further letter,² a week later, again to Ross, she wrote:



Figure 1 Lady (Dorothy) Stanley, née Tennant, who wrote two letters (previously unpublished) to Ross outlining her late husband's views on malaria transmission (reproduced by permission of the Wellcome Library, London).

"I have read with intense interest, and finished with regret the account of your researches on malaria—The only account comparable to it, is that of Pasteur's Researches, given in his Life ... I think you *should* leave this complete record, written by yourself for future ages ...".

Ross was in fact to publish (presumably unbeknown to Dorothy Stanley) his *Memoirs* in 1923!

The "miasmatic" theory of malaria transmission dates back a long way into history; Hippocrates (460-375 BC) had for example, in *Airs, Waters and Places* linked the environment with disease.³ The term malaria was in fact derived from "bad air" which emanated from marshes. Giovanni Maria Lancisi (1654-1720), physician to the pope and professor at the Sapienza in Rome published *De noxiis paludum effluviis, eorumque remediis* in 1717⁴; although this title indicates that he, like most of his contemporaries subscribed to the

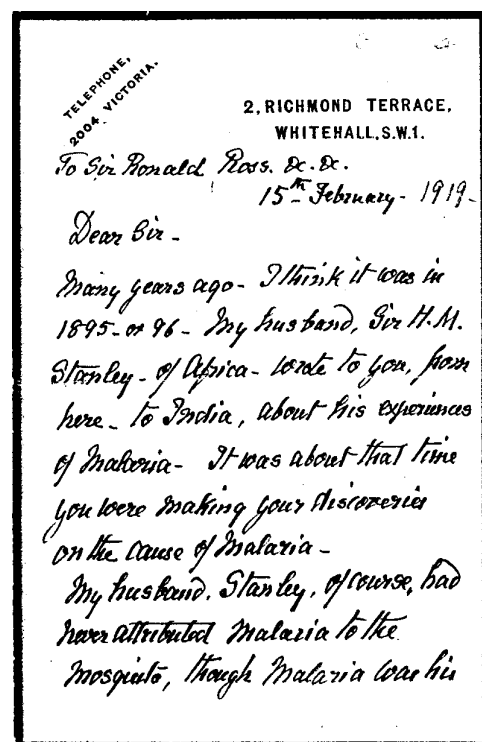


Figure 2 Initial page of the first letter written by Lady (Dorothy) Stanley to Ross, dated 15 February 1919 (reproduced by permission of the Ross Archivist, London School of Hygiene and Tropical Medicine).

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“miasmatic” hypothesis, he suggested the possible role of mosquitoes in transmission of the disease. Lancisi suggested that since malaria disappears after drainage (which he planned for marshy regions) it was caused by some sort of poison emanating from marshes, and was possibly transmitted by mosquitoes. He was not alone in this latter view; Albert Freeman Africanus King (1841–1914) suggested, in 1883, the possible role of mosquitoes.⁵ An attempt to dispel the miasmatic hypothesis was also made by Jakob Henle (1809–85) who published an essay *Von den Miasmen und Kontagien* (1840)⁴; however, in this he felt that although many diseases were *not* caused by miasmas, malaria certainly was, and therefore remained the classical example of an illness transmitted by this means. Alison had written in 1839: “Intermittent fever, more familiarly known as ague, is ... a common product of air which is vitiated with effluvia arising from the soil”.⁶ “Ague [he continued] is a much milder disease than the remittent fever, which springs from the same general source, viz. terrestrial effluvia, and which prevails in the East and West Indies, and on the coast of Africa”. In referring to the diminution in prevalence of ague in Britain, Alison wrote: “By [clearing the wood and] draining, the water which formerly formed a receptacle for the decomposition of animal and vegetable remains, is now carried off, and with it the opportunity it afforded for the extrication of unwholesome vapours”. Sullivan, writing in 1877, considered that “marsh malarial fever” was “generated by a specific telluric miasma”.⁷ This, he continued, “... varies from a simple intermittent to a fever of pernicious type, so does the soil from whence it originates vary both in constitution and appearance from the old classic marsh, clothed with rank vegetation, to the barren soil, even to the sandy desert”. “Should we expose ourselves [he wrote] to the cool night air in a marshy locality we are certain to inhale the infection”. “The miasma is drawn out by evaporation, and when the soil cools down after sunset, the watery vapours become condensed under the form of a fog, which retains the malarial emanations suspended in the atmosphere. This fog, like a funeral pall, is visible in certain localities, as in the Pontine Marshes, and the Campana (sic) near Rome, and in certain regions near to the equator is thick enough to shut out the brilliancy of the stars, and woe be to the man who is not sheltered from its influence!” “The winds [he continued], no doubt, bear an important part in disseminating these miasmatic vapours, conveying them away to distant localities, and thus they become the true carriers of disease and of death”. He concluded: “The theory that fever and ague derive their origin solely from a marshy soil has undergone great modification”.

Less than a decade before Ross’ discovery of mosquito involvement in malaria transmission, the miasma hypothesis remained the favoured option; Priestley, writing in 1889, gave a masterly review of the mode of transmission of this deadly disease.⁸ In “some

of the upper provinces of India” she wrote, “birds and beasts [are compelled] to migrate [as a result of malaria] during the more unhealthy time of year”. She proceeded to quote the views of Bishop Reginald Heber (1783–1826) of Calcutta:

“I asked [he wrote] if it were true that the monkeys forsook these woods during the unwholesome months”. His answer was “that not the monkeys only, but everything which has the breath of life instinctively deserts them from the beginning of April to October. The tigers go up the hills; the antelopes and wild hogs make incursions into the cultivated plain; and those persons, such as dāk-bearers, or military officers who are obliged to traverse the forest in the intervening months, agree that not so much as a bird can be heard or seen in the frightful solitude. Yet, during the time of the heaviest rains, while the water falls in torrents, and the cloudy sky tends to prevent evaporation from the ground, the forest may be passed with tolerable safety. *It is in the extreme heat, and immediately after the rains have ceased*, in May, the latter end of August, and the early part of September, *that it is most deadly*. In October the animals return. By the latter end of that month the wood-cutters and the cowmen again venture, though cautiously. From the middle of November to March troops pass and re-pass, and with common precaution no risk is usually apprehended”.

She then told her readership (quoting Sir Thomas Watson’s *Practice of Physic* [1871]) about the most recent ideas of causation:

“The effluvia which form the sole exciting cause of intermittent and remittent fevers are believed to proceed from the surface of the earth, and are probably gaseous or aëriiform; at any rate they are involved in the atmosphere. But they are imperceptible by any of our senses. Of their physical or chemical qualities we really know nothing”.

Concerning method(s) of transmission, Priestley quoted from Vandyke Carter, Principal and Professor of Medicine at Grant College, Bombay:

“... nothing definite has yet been learnt of the mode and time of the first introduction of germs into the blood, though, according to current views, the malarial infection can be acquired through both air and water, and this research would certainly suggest the channel of drinking-water by preference”.⁹

Only when looked at in this light can the full value of Ross’ two major discoveries, made in 1897 and 1898,⁹ be fully appreciated.

1 Stanley D to Ross R. 15 February 1919: 8. (Ross Archive, London School of Hygiene and Tropical Medicine.)

2 Stanley D to Ross R. 22 February 1919: 4. (Ross Archive, London School of Hygiene and Tropical Medicine.)

3 Norman JM, ed. *Morton’s medical bibliography*. 5th Ed. Aldershot, England: Scolar Press 1991: 805.

4 Singer C, Underwood EA. *A short history of medicine*. 2nd Ed. Oxford: Clarendon Press, 1960:854.

- 5 Major RH. *Classic descriptions of disease with biographical sketches of the authors*. 3rd Ed. Springfield, Illinois: CC Thomas, 1978: 104–8.
- 6 Alison SS. *An inquiry into the propagation of contagious poisons, by the atmosphere; as also into the nature and effects of vitiated air, its forms and sources, and other causes of pestilence; with directions for avoiding the action of contagion, and observations on some means for promoting public health*. Edinburgh: Maclachlan, Stewart & Co, 1839: 132–9.
- 7 Sullivan J. *The endemic diseases of tropical climates with their treatment*. London: J&A Churchill, 1877: 15–42.
- 8 Priestley E. The mysteries of malaria. *The Nineteenth Century* 1889;**25**:852–67.
- 9 Cook GC. Ronald Ross (1857–1932): 100 years since the demonstration of mosquito transmission of *Plasmodium* spp.—on 20 August 1897. *Trans R Soc Trop Med Hyg* 1997; **91**:487–8.